The efficiency of Bremsstrahlung production in an x-ray tube

A. Decreases with both increasing atomic number of the target and increasing electron energy
B. Decreases with increasing atomic number of the target, but increases with increasing electron energy
C. Increases with both increasing atomic number of the target and increasing electron energy
D. Increases with increasing atomic number of the target, but decreases with increasing electron energy

The probability of Bremsstrahlung production is given by $ZE/(n+ZE)$, where $Z$ is the atomic number, $E$ is the energy (in MeV), and $n$ is an empirical constant.

All of the following properties of tungsten make it desirable as the target of a diagnostic x-ray tube except ________

A. Tungsten has a high atomic number
B. Tungsten has a high melting point
C. Tungsten is a good conductor of electricity

The high $Z$ of tungsten makes Bremsstrahlung production more efficient, while the high melting point of tungsten keeps the target from melting.

In an ideal spectrum of Bremsstrahlung emitted from a thick target,

A. The greatest number of photons are emitted with high energies.
B. The greatest number of photons are emitted with low energies.
C. The number of photons emitted is independent of energy.

In a thick-target spectrum the number of photons is given by $I(E) = CZ(E_0 - E)$. 
Which of the following statements regarding a real thick-target x-ray spectrum is true?

A. Characteristic x-rays do not play a role in the emitted x-ray spectrum.
B. Low energy x-rays are selectively absorbed in the target.
C. The greatest number of x-rays are emitted at the highest energies.
D. The greatest number of x-rays are emitted at the lowest energies.

Which of the following statements regarding a real thick-target x-ray spectrum is true?

B. Low energy x-rays are selectively absorbed in the target.

You are taking an abdominal CT scan of a patient using an x-ray machine with a tube potential of 120 kV. The photons produced by the CT scanner are filtered by aluminum between the x-ray source and the patient. The primary reason the machine has this aluminum filter is to

A. Decrease patient dose by hardening the x-ray spectrum.
B. Improve the image quality by reducing photon scatter.
C. Remove any remaining electrons from the beam.
D. Remove characteristic x-ray contamination.

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A. Decrease patient dose by hardening the x-ray spectrum.

The aluminum filter attenuates a large number of lower-energy photons that would otherwise be absorbed in the patient and not reach the detector.

Is a flattening filter needed for an x-ray beam of energy 100 kVp?

A. No, because the angular distribution of the Bremsstrahlung x-rays is nearly isotropic
B. No, because the production of characteristic x-rays is negligible
C. Yes, because the angular distribution of the Bremsstrahlung x-rays is peaked in the forward direction
D. Yes, because the angular distribution of the characteristic x-rays is peaked in the forward direction.

Is a flattening filter needed for an x-ray beam of energy 100 kVp?

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At kilovoltage x-ray energies, emission of Bremsstrahlung is nearly isotropic.
Which of the following statements regarding the heel effect is true?

A. A patient is positioned for a breast radiograph with the apex of the breast aligned with the heel of the x-ray target to take advantage of the reduced beam intensity.
B. A patient is positioned for x-ray treatment of the breast with the apex of the breast aligned with the heel of the x-ray target to take advantage of the reduced beam intensity.
C. Changes in x-ray beam intensity caused by the heel effect can be compensated for through the use of flattening filters.

In a therapeutic x-ray beam, which statement regarding patient placement is true?

A. The patient is positioned on the axis of the electron beam.
B. The patient is positioned at an angle of 45° from the axis of the electron beam.
C. The patient is positioned at right angles to the axis of the electron beam.

In a therapeutic x-ray beam, in which flattening filters are designed to deliver a flat beam at a depth of 10 cm, the x-ray intensity at the periphery of the field at a depth of 2 cm will be _________ the x-ray intensity at central axis at the same depth.

A. Greater than
B. Less than
C. The same as

In a therapeutic x-ray beam, in which flattening filters are designed to deliver a flat beam at a depth of 10 cm, the x-ray intensity at the periphery of the field at a depth of 2 cm will be _________ the x-ray intensity at central axis at the same depth.

A. Greater than

The flattened x-ray beam is harder along the central axis than at the periphery, so in order to deliver a uniform dose at 10 cm depth, the beam intensity at the periphery of the beam at 2 cm must be greater than that along central axis.